

MA2001: MULTI-VARIABLE CALCULUS AND LINEAR ALGEBRA

Effective Term

Semester A 2022/23

Part I Course Overview

Course Title

Multi-variable Calculus and Linear Algebra

Subject Code

MA - Mathematics

Course Number

2001

Academic Unit

Mathematics (MA)

College/School

College of Science (SI)

Course Duration

One Semester

Credit Units

3

Level

B1, B2, B3, B4 - Bachelor's Degree

Medium of Instruction

English

Medium of Assessment

English

Prerequisites

MA1201 Calculus and Basic Linear Algebra II / MA1301 Enhanced Calculus and Linear Algebra II; or equivalent

Precursors

Nil

Equivalent Courses

Nil

Exclusive Courses

MA2158 Linear Algebra and Calculus

Part II Course Details

Abstract

This course aims to introduce important ideas in Linear Algebra and Advanced Calculus necessary for an understanding of their application to Science and Engineering. It will help students develop the ability to think quantitatively and analyse problems critically.

Course Intended Learning Outcomes (CILOs)

CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1 explain clearly mathematical concepts from linear algebra, and advanced calculus.	10	x	x	
2 compute eigenvalues and eigenvectors of matrices and implement eigenvalue decompositions.	20	x	x	
3 evaluate partial derivatives, local extrema and Taylor series of multivariate functions.	30	x	x	x
4 evaluate multiple integrals, line and surface integrals, and perform the theorems of Green, Divergence and Stokes.	30	x	x	x
5 apply mathematical and computational methods to a range of applications involving linear algebra and multi-variable calculus.	10	x	x	x

A1: Attitude

Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.

A2: Ability

Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to real-life problems.

A3: Accomplishments

Demonstrate accomplishment of discovery/innovation/creativity through producing /constructing creative works/new artefacts, effective solutions to real-life problems or new processes.

Teaching and Learning Activities (TLAs)

TLAs	Brief Description	CILO No.	Hours/week (if applicable)
1 Lectures	Learning through teaching is primarily based on lectures.	1, 2, 3, 4, 5	Min 39 hours to a max of 52 hours in total
2 Tutorials	Learning through tutorials is primarily based on interactive problem solving allowing instant feedback.	2	2 hours

3	Tutorials	Learning through tutorials is primarily based on interactive problem solving allowing instant feedback.	3	4 hours
4	Tutorials	Learning through tutorials is primarily based on interactive problem solving allowing instant feedback.	4	5 hours
5	Tutorials	Learning through tutorials is primarily based on interactive problem solving allowing instant feedback.	1, 5	2 hour
6	Take-home assignments	Learning through take-home assignments helps students understand basic concepts and techniques of linear algebra, multi-variable calculus and their applications.	1, 2, 3, 4, 5	after-class
7	Online applications	Learning through online examples for applications helps students apply mathematical and computational methods to some problems in applications.	5	after-class
8	Math Help Centre	Learning activities in Math Help Centre provides students extra help.	1, 2, 3, 4, 5	after-class

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Test	1, 2, 3, 4	20	Questions are designed for the first part of the course to see how well the students have learned concepts and techniques of linear algebra and multi-variable calculus.
2	Hand-in assignments (Quizzes +Webwork)	1, 2, 3, 4, 5	4	These are skills based assessment to help students demonstrate advanced concepts and techniques of linear algebra, multi-variable calculus and some applications in science and engineering.

3	Formative take-home assignments	1, 2, 3, 4, 5	6	The assignments provide students' chances to demonstrate their achievements on linear algebra and multi-variable calculus learned in this course.
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Continuous Assessment (%)

30

Examination (%)

70

Examination Duration (Hours)

2

Additional Information for ATs

30% Coursework

70% Examination (Duration: 2 hours, at the end of the semester)

For a student to pass the course, at least 30% of the maximum mark for the examination must be obtained.

Assessment Rubrics (AR)**Assessment Task**

1. Test

Criterion

Intermediate stage: ability to understand the concepts and techniques of linear algebra and multi-variable calculus

Excellent (A+, A, A-)

High

Good (B+, B, B-)

Significant

Fair (C+, C, C-)

Moderate

Marginal (D)

Basic

Failure (F)

Not even reaching marginal levels

Assessment Task

2. Hand-in assignments

Criterion

Carefully selected fundamental problems to test students' ability to demonstrate advanced concepts and apply analysis techniques to science and Engineering

Excellent (A+, A, A-)

High

Good (B+, B, B-)

Significant

Fair (C+, C, C-)

Moderate

Marginal (D)

Basic

Failure (F)

Not even reaching marginal levels

Assessment Task

3. Formative take-home assignments

Criterion

Exercises and practices to demonstrate students' achievements on linear algebra and multi-variable calculus learned in this course

Excellent (A+, A, A-)

High

Good (B+, B, B-)

Significant

Fair (C+, C, C-)

Moderate

Marginal (D)

Basic

Failure (F)

Not even reaching marginal levels

Assessment Task

4. Examination

Criterion

Ability to demonstrate their versatility in linear algebra and multi-variable calculus

Excellent (A+, A, A-)

High

Good (B+, B, B-)

Significant

Fair (C+, C, C-)

Moderate

Marginal (D)

Basic

Failure (F)

Not even reaching marginal levels

Part III Other Information**Keyword Syllabus**

Linear Algebra (3 weeks): Orthogonality; Eigenvalues and eigenvectors; Eigenvalue decompositions.

Multi-variable Calculus (10 weeks): Functions of several variables; Partial differentiation; Multi-variable Taylor series; Multiple integration; Gradient, divergence and curl; Line and surface integrals; Theorems of Gauss, Stokes and Green.

Reading List**Compulsory Readings**

Title	
1	https://www.cityu.edu.hk/ma/programmes/undergraduate/non-BSCM-students/topics-recommended-readings-servicing-courses#heading6

Additional Readings

Title	
1	Elements of Advanced Engineering Mathematics by Peter V. O'Neil, Cengage Learning, 2011
2	Linear Algebra and Its Applications, 4/E, by David C. Lay, Pearson, 2011
3	Thomas' Calculus, Multivariable (12th Edition) by George B. Thomas Jr. , Maurice D. Weir, Joel R. Hass, 2009
4	Multivariable Calculus with Matrices (6th ed.) by C. Henry Edwards and David E. Penney, Prentice Hall, 2002